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Description

The pr sent invention geneally relates to structures for protecting radar equipment which are currently called "Radomes" and more particularly to a structure of this type which is improved in its construction, radar trasparency and weight.

As known, in the installation of rotating radar antennas of large dimensions for controlling the air traffic there is more and more the requirement to arrange round the antenna a structure which is weatherproof and at the same time capable of retaining the necessary transparency to the electromagnetic waves emitted and received by the radar equipment.

The structures at present used for radomes of this class are of the following types:

a) shell type radomes comprising a shell in the shape of a spherical bowl having a diameter up to 10 m and generally used for radar equipment having small and middle dimensions,

b) space frame radomes comprising a frames made of metal and membranes made of fiberglass reinforced resins having a diameter up to 30 m and used for radar equipment of large dimensions,

c) panelled radomes comprising rigid flanged panels which are directly connected to each other at the edges and also used for radar equipment of large dimensions.

The stresses that these radomes will undergo are very strong because the radomes must resist to very adverse environmental conditions, for example wind velocities of the order of hundreds km/h, violent hails, high temperatures and so on.

Therefore, the radomes must be very sturdy and at the same time must hinder as little as possible the propagation of the electromagnetic waves.

The above mentioned radomes, particularly those described in items b) and c) to which the present invention particularly refers, are very heavy structures because they make use of metal frames for supporting the various panels made of fiberglass reinforced resins. Even if ligth metals are used, for example aluminium, the structures are still heavy, what results in higher manufacturing and transporting costs. Furthermore, the use of metal frame structures affect also the radar transparency, because they largely affect the dielectric homogeneity of the structure.

Also space frame radomes have been manufactured comprising frames of fiberglass reinforced resins, rather than metal, to the purpose to reduce the weight and the dielectric heterogeneity thereof, however, while the radome weight is reduced, the overlapped and space frame joints represent again a negative factor because they exhibit concentrated locations of material which give rise to changes of the radome dielectric homogeneity.

In the structures having flanged panels, the joints of the various panels are a great disadvantage. In fact, the overlapped and space frame joints at present employed will interfere with the radar transparency for the above mentioned reasons.

The present invention aims at obviating the above mentioned disadvantages by providing an improved radome having an increased radar transparency and a lower weight with respect to the prior art radomes, while assuring the required resistance to the stresses which it is undergoing.

More particularly, the radome according to the present invention is of the panelled type with rigid panels connected to each other by means of a framework and is characterized in that:

- the framework is formed of fiberglass reinforced resin laminates, arranged to form a structure which is electromagnetically matched to the operative frequency of the associated antennas,
- the panels are of the sandwich type and comprise a pair of parallel skin laminates enclosing a core of a foamed or honeycomb plastic material;
- the joints between the framework and the panels are bolted joints,
- the geometry of the panels is based on an arrangement of hexagonal and pentagonal patterns obtained by using trapezoids so as to form an arrangement of sections positioned and oriented in a pseudo random manner.

The present invention will be now described in more detail in connection with a preferred embodiment thereof, given by way of example only and therefore not intended in a limitative sense, illustrated in the accompanying drawings, wherein:

Fig. 1 is an elevation side view of the radome according to the present invention;

Fig. 2 is a plan and side elevation view, respectively, of a detail of the radome structure showing the trapezoidal and pentagonal pan ls used for forming a pentagonal pattern;

Fig. 3 is a plan and side elevation view, respectively of a detail of the radome structure showing the trap zoidal and hesagonal panels used for forming a hexagonal pattern;

Fig. 4 is a plan and front view, respectively of a joint strap of th framework;

Fig. 5 is a plan view of the shape of the four cap types forming part of the framework;

Fig. 6 is a plan view of a detail of the radome structur showing the panels forming a hexagonal and a pentagonal pattern with the associated joint straps and caps in the assembled condition;

Fig. 7 is a plan view of a first type of joint of the framework elements;

Fig. 8 is a plan view of a second type of joint of the framework l ments;

Fig. 9 is a plan view of a third type of joint of the framework elements;

Fig. 10 is a plan view of a fourth type of joint of the framework elements;

Fig. 11 is a partial cross-section view of a panel according to the invention;

Fig. 12 is a cross-section view taken along the line XII-XII of Fig. 8;

Fig. 13 is a cross-section view taken along the line XIII-XII of Fig. 10;

Fig. 14 is a partial cross-section view of a device for anchoring the radome to the ground.

As already said, the object of the invention is to provide a radome of large dimensions which is particularly transparent to the elctromagnetic waves and at the same time has such a structural sturdiness as to resist to the strong stresses to which it is subjected during use, such as temperature, wind, humidity, hail, dust, seismic load and snow.

For attaining the above objects the main components of the radome, such as framework, panels, joints and geometry have been designed and tested in order to obtain the required features.

The above components will be now described in more detail in connection with the drawings.

RADOME GEOMETRY

It is known that in order to avoid the increase of the side lobes of the antennas, the geometry of the radome must be as little periodical as possible in order that the diffraction contributions of the single elements of the framework are randomly generated both as polarisation and amplitude and phase of the diffracted field and cannot add again in phase in any direction.

However, this requirement of operating with a structure as irregular as possible is contrasted by the industrial requirement of obtaining a limited number of different panel types. Therefore, an optimal compromise among these opposite requirements is represented by a polyhedric bowl structure 10 (Fig. 1) for containing the radar antennas R (shown in dotted lines), the faces of which are formed of two basic polygons, namely the regular pentagon and the regular hexagon. More particularly, as can be seen from Fig. 2 and 3, the two polygonal patterns are obtained by means of a small regular pentagon 11 centered in a large regular pentagon 12 (Fig. 2) formed by the arrangement of five similar trapezoids 13, each arranged with the smaller base thereof adjacent an associated side of the small regular pentagon 11 and with a small regular hexagon 14, respectively, centered in a large regular hexagon 15 (Fig. 3) formed by the arrangement of six similar trapezoids 16, each of which is arranged with the smaller base thereof adjacent an associated side of the small hexagon 14. The larger basis of all the trapezoids are equal. To facilitate the construction, the small hexagon is divided in two pentagons 17 and 18. By following this geometry, there is obtained an alternate, repeating arrangement of large pentagons surrounded on all the five sides by large hexagons. In this manner, by simply providing four types of panel shapes, namely the small pentagon 11, the small hexagon 14, the trapezoids 13 for forming the large pentagon 12 and the trapezoids 16 for forming the large hexagon 15, the polyhedric structure 10 of the radome can be obtained.

FRAMEWORK

The components of the framework, in this case, are joint straps 20 (Fig. 4) and caps 30 (Fig. 5). The purpose of the joint straps 20 is to connect the panels to each other along their sides, whereas the purpose of the caps 30 is to connect the joint straps 20 to each other at the apexes of the geometric figures of the four types of radome panels.

As can be seen from Fig. 5, the caps 30 for connecting the joint straps have different shapes in accordance with their application site. In this case, in order to follow the described geometry, four types of caps 30 are used, namely Y-shaped caps 31, T-shaped caps 32 angled caps 33 for the pentagon and angled caps 34 for the hexagon. As shown in Fig. 12 and 13, the framework is obtained by using inner and outer joint straps 20 and inner and outer caps 30 arranged along the sides of the panels.

In the described embodiment, the plastic laminate used for forming the joint straps and tha caps essentially comprises a matrix of a fiberglass reinforced polyester resin. A type of reinforcement comprises a fib rglass in the form of fabric having preferably a weight of 800 g/m^2, coupled to fiberglass mats having preferably a weight of 300 g/m^2. The matrix is comprised of a polyester resin containing isophthalic acid as a component thereof and ther aft r referr d to as isophthalic type polyester resin. This polyester resin is self-extinguishing. The curing of the laminate is carri d out by means of peroxid catalists. For having

laminates of white color a white pigment is added to the molding mass. This pigment is g nerally titanium dioxide. Furthermore, in order to preserve the laminates against the environmental conditions, a protective gel coat is applied thereon, preferably an isophthalic-neopentilic gel coat. The laminate is produced in the best manner by press molding and/or in an autoclave.

A preferred but not limitative method of obtaining the laminates used in this embodiment comprises the steps of spraying the gel coat in the mold, harden this gel coat, laminating the panel with four fiberglass layers by adding the polyester resin with catalist and pigment and curing in the mold the so obtained mass at a temperature of about 80 • C. The laminate is then trimmed and cut in the desired shapes and then holes are drilled therein at the locations required for the bolted joints. The holes provided in the joint straps are designed byh 23 and the holes provided in the caps are designed by 35. The main physical features of the joint straps and the caps obtained in accordance with this embodiment are given in the following table 1.

TABLE I

Thickness	4 mm
Density	1,74 g/cm^3
Resin	39% to 41% by weight
Woids	less than 2% by volume
Ultimate tensile stress	250 N/mm^2
Ultimate strain	1,74%
Tensile moduls	16.500 N/mm^2
Ultimate compressive stress	177 N/mm^2
Compression moduls	19.000 N/mm^2
Interlaminar shear	13,5 N/mm^2
Inplane shear	41,2 N/mm^2
Poisson ratio 0 • C	0,185
Poisson ratio 90 • C	0,150
Dielectric constant 1 MHz	3,55
Dissipation factor 1 MHz	7,74 x 10^{-3}

Of course, the plastic laminates for forming the joint straps and the caps can have a different number of layers and can be obtained from a resin other than the isophthalic type polyester resin. Also the reinforcement can be of a type different from that of the fiberglass, for example carbon fibers.

PANELS

As already said, the panelling generally indicated by 40 follows the standard geometry of the radome structure, so that there will be panels of four shapes, namely: pentagonal panels 41, hexagonal panels 42, trapezoidal panels 43 for the pentagon and trapezoidal panels 34 for the hexagon. Again, the hexagonal panels 42 are divided along a center line passing through two opposed sides of the hexagon, in two pentagonal panels 45,46 for assembly facility.

As can be seen from Fig. 11, panels 40 are of sandwich type. In fact, they have two skin parallel laminates 47 of fiberglass reinforced polyester resin which encompass a core 48 of polyurethane foam. Here again, as reinforcement material a glass fabric is employed having preferably a weight of 800 gr/m^2 coupled to fiberglass mats having preferably a weight of 300 gr/m^2. The employed polyester "resin is preferably an isophthalic type polyester resin as that used for the joint straps and the caps. The polyurethane foam is of a rigid and self-extinguishing type and is obtained with the "continuous block" molding method. The panels 40 are coated with a gel coat of isophthalic-neopentilictype, applied on the outer skin of the sandwich panel. The panels are obtained by press-molding or in an autoclave, followed by a trimming and then the holes 49 for the assembly with the joint straps and the caps are drilled therein.

A preferred but not limitative method of obtaining the sandwich panels comprises the steps of cleaning the mold and applying thereto a release agent, spraying the gel coat, laminating the outer skin, positioning the polyurethane foam on said skin, laminating the inner skin and curing in the mold at a temperature of 80 • C. The skin laminates 47 and the core 48 of polyurethane foam so obtained show a high dielectric constant and the thickness of the cor 48 of polyurethane foam is depending on the operative frequency of the radar equipment so as to obtain a radome 10 having the radar transparency required at least in the radar operating band. It has been found that a thickness of the polyurethane foam core suitable for the

radome 10 according to the inv ntion is 32 mm.

Of course, although the panels have been described in connection with the above mentioned preferr d embodiment, it should be und rstood that also in this case the laminates can include any number of layers and the employed resins can be of any type belonging to th thermosetting resins. Here also, the fibers can be different from the fiberglass employed, for example carbon fibers. Furthermore, instead of the polyurethane foam, also honeycomb plastic materials can be used.

PANEL JOINTS

As already said and shown in Fig. 12, all the joints are of bolted type and employ preferably bolts and nuts in stainless steel, and the connections of the panels along their sides are obtained by inserting the bolts 50 through the holes 23 of the outer joint strap (in Fig. the joint strap 22), then through the holes 40 of the panel and then through the holes 23 of the inner joint strap and tightening the nuts 51. If necessary, a bushing can be inserted in the holes. The junctions of the caps 30 to the associated panels are obtained by inserting the bolts 51 through the holes 35 of the outer caps (in Fig. 13 the Y-shaped caps 31), then through the end hole 23 of the outer joint straps (in Fig.12 the joint straps 22), then through the holes 49 of the panels and through the end holes 23 of the inner joint straps and then through the holes 35 of the inner caps and finally tightening the nuts 51 on the bolts. In particular, as already said in connection with the description relating to the framework, the caps 30 are of four types, namely: angled caps 33,34, T-shaped caps 32 and Y-shaped caps 31.

The angled caps 33 (Fig. 7) are used for connecting to each other three joint straps 22 belonging to the pentagon 11 and therefore they form an angle of 72°, whereas the angled caps 34 (Fig. 8) are used for connecting to each other the joint straps 22 belonging to the hexagon 14 and therefore form an angle of 60°.

The angled caps 33 are applied at the apexes of the radome indicated by A in Fig. 6 and therefore they connect the pentagonal panel 41 to two trapezoidal panels 43 through three joint straps 22.

The angled caps 34 are applied at the apexes of the radome indicated by B in Fig. 6 and therefore they connect the hexagonal panel 42 to two trapezoidal panels 44 through three joint straps 22.

The T-shaped caps 32 (Fig. 9) are applied in the location indicated by C in Fig. 6 and therefore they connect the pentagonal panels 45 and 46 of the hexagonal panel 42 and one trapezoidal panel 44 through two joint straps 22 of the hexagon 14 and the joint strap 21 arranged at the separating point of the hexagon 14 in two pentagons 17 and 18 (Fig. 3).

The Y-shaped caps 31 (Fig. 10) are applied at the apexes of the radome indicated by D in Fig. 6 and therefore they connect four panels 44 to two panels 43 through the six joint straps 22 which converge in the apex D formed by a corner of the large pentagon and by two corners of two large hexagons adjacent the large pentagon.

In Fig. 14 there is shown the anchoring system employed for securing the base panels of the radome to ground. As can be seen from Fig. 1 the base panels 70 have not the shape of the other panels for assembly reasons. However, their shape is not important for the present invention because the radar transparency therein is not of interest. The anchoring system of the panels comprises stud bolts 61 fixed in the beton basement 60, each of which has at the fixed end a retaining plate 62 fastened through a pair of nuts 63. The opposite end of the stud bolts extends from the basement 60 and is intended to fasten by means of a nut 64 a metal plate 65 having substantially the thickness of the base panels 70. This plate 65 is bent to an angle corresponding to the dihedral angle that the base panel 70 forms with the basement 60. The metal plate 65 is provided of two metal plates 66,67 bolted thereto by means of the bolts 68 on both the surfaces thereof and retaining the base panel 70 therebetween.

Of course, the radome 10 is provided with the conventional entry door 71, the conventional lightning rod 72 and the conventional top illumination system 73, as can be seen from Fig. 1.

The advantages offered by the radome according to the present invention are both of mechanical and electromagnetic type as follows.

1) From experiments conducted it has been found that the radome according to the present invention can resist to the following environmental conditions:

T mperature	-50 °C to +70 °C
Operation wind	up to 270 km/h
Humidity	100%
Hail	up to 50 mm diameter
Dust	2 g/m³
Seismic load	1 G lateral
Snow (wet)	up to 0,5 m helht
Snow (dry)	up to 2,0 m height

2) From the electromagnetic standpoint the randome according to the present invention has a structure which is intrinsically "matched" to the frequency of the radar equipment to be contained therein and a higher radar transparency than that obtained by direct connection of the panel edges, as in the known radomes. In this case the joints can have a transmittivity of at least 95%, the transmission losses of all the radome are less than -0,2 dB and the increase of the side lobes is contained within 1,5 dB for lobes originally lying at -25 dB.

3) From the constructive standpoint the radome of the invention is provided with a set of basic panels having four different shapes and a minor set of base panels and therefore represents an optimal compromise between the electromagnetic requirements of radar transparency and the production requirement. The only metal elements are the bolts and nuts necessary for the joints between the panels and the framework. The latter, being fully formed of glassfiber reinforced resin, offers the great advantage of a reduced weight with respect to the metal structures and, because the employed plastic material is the same both for the framework and the panelling, it contributes in a decisive manner to the radar transparency required by the radome because framework and panels form a homogeneous structure.

4) Also the transport, assembly and servicing are very facilitated by the radome according to the invention because the types of panels, joint straps and caps have been minimized.

Claims

1. Radome of panelled type with rigid panels connected to each other by means of a framework, characterized in that:
   - the framework (20,30) is formed of fiberglass reinforced resin laminates (20,30), arranged to form a structure which is electromagnetically matched to the operative frequency of the associated antennas,
   - the panels (40) are of the sandwich type and comprise a pair of parallel skin laminates (47) enclosing a core (48) of a foamed or honeycomb plastic material;
   - the joints (A,B,C,D) between the framework (20,30) and the panels (40) are bolted joints,
   - the geometry of the panels (40) is based on an arrangement of regular hexagonal patterns (42,44) and pentagonal patterns (41,43) obtained by using trapezoids so as to form an arrangement of sections positioned and oriented in a pseudo-random manner.

2. Radome as claimed in claim 1, characterized in that the laminates (20,30) of fiberglass reinforced resin are joint straps (20,30) for connecting the panels (40) along their sides and caps (30) for connecting the joint straps (20) at the apexes of the polygons forming the basis of the radome geometry.

3. Radome as claimed in claim 1, characterized in that the reinforcing fibers are glass fibers or carbon fibers or the like.

4. Radome as claimed in claim 2, characterized in that the joint straps (20) and the caps (30) are made of fiberglass reinforced isophthalic type polyester resins.

5. Radome as claimed in claim 1, characterized in that the skin laminates (47) of the sandwich panels are made of fiberglass r inforced isophthalic type polyester resin and th panel cores (48) are made of a polyurethane foam or a honeycomb plastic material.

6. Radome as claim d in claim 1, characterized in that the framework (20,30) and the panels (40) are connected to each other by means of stainless steel bolts (50).

7. Radome as claimed in claim 1, characterized in that th regular pentagonal pattern (41,43) of the radom geometry is comprised of a small regular pentagon (41) centered in a large pentagon formed by five trapezoids (43) each of which is arranged with its smaller base adjacent an associated side of the small pentagon (41).

8. Radome as claimed in claim 1, characterized in that the regular hexagonal pattern (42,44) of the radome geometry is comprised of a small regular hexagon (42) centered in a large hexagon formed by six trapezoids (44) each of which is arranged with its smaller base adjacent an associated side of the small hexagon (42).

9. Radome as claimed in claims 1,7 and 8, characterized in that the regular pentagonal and hexagonal patterns (41,43; 42,44) are arranged so that each pentagonal pattern (41,43) is encompassed by five hexagonal patterns (42,44).

10. Radome as claimed in claim 1, characterized in that there are four types of panels (40), namely pentagonal panels (41), hexagonal panels (42), trapezoidal panels (43) for the pentagonal panels (41) and trapezoidal panels (44) for the hexagonal panels (42).

11. Radome as claimed in claim 10, characterized in that the hexagonal panels (42) are divided in two pentagonal panels (45,46) along the line passing through the centers of two opposite sides of the hexagon (42).

12. Radome as claimed in claim 2, characterized in that the joint straps (20) have a straight (21) or angled (22) cross-section and the caps (30) are of four types, namely an angled cap (33) for the pentagonal panels (41), an angled cap (34) for the hexagonal panels (42), a T-shaped cap (32) for the two pentagonal panels (45,46) in which the hexagonal panel (42) is divided and a Y-shaped cap (31) for connecting to each other four trapezoids (44) of one hexagonal panel (42) to two trapezoids (43) of one pentagonal panel (41).

Patentansprüche

1. Plattenartiges Radom aus steifen Platten, die über ein Tragwerk miteinander verbunden sind, dadurch gekennzeichnet, daß
   - das Tragwerk (20,30) aus mit glasfaserverstärkten Formteilen (20,30) gebildet ist, die so angeordnet sind, daß sie ein mit der Arbeitsfrequenz der zugeordneten Antennen elektromagnetisch abgestimmtes Gebilde bilden,
   - daß die Platten (40) von der Sandwichart sind und aus zwei parallelen äußeren Schichten (47) bestehen, die einen Schaumstoff- oder wabenförmigen Kern (48) einschliessen,
   - daß die Verbindungen (A,B,C,D) zwischen dem Tragwerk (20,30) und dem Platten (40) Schraubverbindungen sind,
   - daß die Geometrie der Platten (40) auf einer Anordnung von regelmäßigen Sechsecken (42,44) und Fünfecken (41,43), die durch die Verwendung von Trapezen erhalten werden, beruht, um eine Anordnung von in zufallsähnlicher Radomart angeordneten und ausgerichteten Abschnitten zu bilden.

2. Radom nach Anspruch 1, dadurch gekennzeichnet, daß die glasfaserverstärkten Formteile (20,30) aus Verbindungsträgern (20,30) zum Verbinden der Platten (40) entlang ihrer Seiten und aus Abdeckteilen (30) zum Verbinden der Verbindungsträger (20) im den Scheitelpunkten der Polygone, die die Grundlage für die Radomgeometrie bilden, bestehen.

3. Radom nach Anspruch 1, dadurch gekennzeichnet, daß die Verstärkungsfasern Glasfasern oder Kohlenstoffasern oder dgl. sind.

4. Radom nach Anspruch 2, dadurch gekennzeichnet, daß die Verbindungsträger (20) und die Abdeckteile (30) aus glasfaserverstärkten isophtalartigen Polyesterharzen hergestellt sind.

5. Radom nach Anspruch 1, dadurch g k nnzeichnet, daß die äußeren Schichten (47) d r Sandwichplatten aus glasfaserverstärktem isophtalartigem Polyesterharz und die Kerne (48) aus Polyurethan-

Schaumstoff oder wabenförmig m Kunststoff hergestellt sind.

6. Radom nach Anspruch 1, dadurch gekennzeichnet, daß das Tragwerk (20,30) und die Platten (40) mittels Schraubenbolzen aus rostfreiem Stahl (50) miteinander verbunden sind.

7. Radom nach Anspruch 1, dadurch gekennzeichnet, daß die regelmäßige Fünfeckform (41,43) der Radomgeometrie aus einem kleinen regelmäßigen Fünfeck (41) besteht, das in einem großen, aus fünf Trapezen (44) gebildetem Fünfeck mittig angeordnet ist, wovon jedes Trapez mit seiner kleinen Grundlinie in der Nähe einer zugeordneten Seite des kleinen Fünfecks (41) angeordnet ist.

8. Radom nach Anspruch dadurch gekennzeichnet, daß die regelmäßige Sechseckform (42,44) der Radomgeometrie aus einem kleinen regelmäßigen Sechseck (42) besteht, das in einem großen, aus sechs Trapezen (44) gebildeten Sechseck mittig angeordnet ist, wovon jedes Trapez mit seiner kleinen Grundlinie in der Nähe einer zugeordneten Seite des kleinen Sechsecks (42) angeordnet ist.

9. Radom nach Anspruch 1, 7 und 8, dadurch gekennzeichnet, daß die regelmäßigen fünfeckigen und sechseckigen Formen (41,43; 42,44) derart angeordnet sind, daß jedes Fünfeck (41,43) von fünf Sechseckformen (42,44) umgeben ist.

10. Radom nach Anspruch 1, dadurch gekennzeichnet, daß vier Arten von Platten (40) vorhanden sind, und zwar fünfeckige Platten (41), sechseckige Platten (42), trapezoidale Platten (43) für die fünfeckigen Platten (41) und trapezoidale Platten (44) für die sechseckigen Platten (42).

11. Radom nach Anspruch 10, dadurch gekennzeichnet, daß die sechseckigen Platten (42) in zwei fünfeckige Platten (45,46) entlang der Linie getrennt werden, die die Mittelpunkte von zwei gegenüberliegenden Seiten des Sechsecks (42) durchquert.

12. Radom nach Anspruch 2, dadurch gekennzeichnet, daß die Verbindungsträger (20) einen linearen (21) oder winkligen (22) Querschnitt aufweisen und die Abdeckteile (30) von vier Arten sind, und zwar eine abgewinkelte Abdeckung (33) für die fünfeckigen Platten (41), eine abgewinkelte Abdeckung (34) für die sechseckigen Platten (42), eine T-förmige Abdeckung (32) für die beiden fünfeckigen Platten (45,46), in die die sechseckige Platte (42) unterteilt ist und eine Y-förmige Abdeckung (31), um vier Trapeze (44) einer sechseckigen Platte (42) mit zwei Trapezen (43) einer fünfeckigen Platte (41) untereinander zu verbinden.

Revendications

1. Radome de type à panneaux rigides réunis les uns aux autres au moyen d'un châssis, charactérisé en ce que:
   - le châssis (20,30) est formé de laminés (20,30) en résine renforçée de fibres de verre, arrangés de manière à former une structure, qui est accordée électromagnétiquement à la fréquence de travail des antennes associées;
   - les panneaux (40) sont de type sandwich et comportent deux laminés extérieures parallèles (47) entourant un noyau (48) formé d'une mousse ou d'un nid d'abeilles en matière plastique;
   - les jonctions (A,B,C,D) entre le châssis (20,30) et les panneaux (40) sont jonctions boulonnées;
   - la géométrie des panneaux (40) se base sur une disposition d'éléments hexagonaux réguliers (42,44) et d'éléments pentagonaux (41,43), qui sont obtenus en utilisant des trapèzes de façon à former une disposition de panneaux arrangés et orientés de façon pseudocasuelle.

2. Radome selon la revendication 1, caractérisé en ce que les laminés (20,30) en résine renforçée de fibres de verre sont des bandes de joint (20,30) pour assembler les panneaux (40) le long de leurs côtés, et des couvercles (30) pour relier les bandes de joint (20) aux arêtes des polygones formant la base de la géométrie du radome.

3. Radome selon la revendication 1, caractérisé en ce que les fibres de renforce sont constituées par de fibres d verr ou de carbon ou similaires.

4. Radome selon la revendication 2, caractérisé en ce que les bandes de joint d'assemblage (20) et les couvercles (30) sont fabriqués en résines polyester de type isophthalique r nforcées de fibres de verre.

5. Radome selon la revendication 1, caractérisé en ce que les laminés extérieures (47) des panneaux sandwich sont fabriqués en résine polyester de type isophthalique et le noyau des panneaux (48) est réalisé en mousse de polyuréthane ou en matière plastique en nid d'abeilles.

6. Radome selon la revendication 1, caractérisé en ce que le châssis (20,30) et les panneaux (40) sont reliés l'un à l'autre à l'aide de boulons (50) en acier inoxydable.

7. Radome selon la revendication 1, caractérisé en ce que la forme pentagonale regulière (41,43) de la géométrie du radome est constituée par un petit pentagone regulier (41) mis au centre d'un gros pentagone formé de cinque trapèzes (43), chaque trapèze étant arrangé avec sa petite base juxtaposée à une côté associée du petit pentagone (41).

8. Radome selon la revendication 1, caractérisé en ce que la forme hexagonale regulière (42,44) de la géométrie du radome est constituée par un petit hexagone regulier (42) mis au centre d'un gros hexagone formé de six trapèzes (44) chaque trapèze étant arrangé avec sa petite base juxtaposée à une côté associée du petit hexagone (42).

9. Radome selon les revendications 1, 7 e 8, caractérisé en ce que les panneaux pentagonaux et hexagonaux reguliers (41,43; 42,44) sont arrangés de façon que chaque panneau pentagonal (41,43) est entouré de cinque panneaux hexagonaux (42,44).

10. Radome selon la revendication 1, caractérisé en ce qu'il y a quatre types de panneaux (40), c'est-à-dire des panneaux de forme pentagonale (41), des panneaux de forme hexagonale (42), des panneaux de forme trapézoïdale (43) pour les panneaux de forme pentagonale (41) et des panneaux de forme trapézoïdale (44) pour les panneaux de forme hexagonale (42).

11. Radome selon la revendication 10, caractérisé en ce que les panneaux de forme hexagonale (42) sont partagés en deux panneaux de forme pentagonale (45,46) le long de la ligne passant par les centres de deux côtés opposées du hexagone (42).

12. Radome selon la revendication 2, caractérisé en ce que les bandes de joint (20) comportent une section trasversale linéaire (21) ou angulaire (22) et les couvercles (30) sont de quatres types, c'est-à-dire un couvercle en forme d'angle (33) pour les panneaux de forme pentagonale (41), un couvercle en forme d'angle (34) pour les panneaux de forme hexagonale un couvercle à T (32) pour les deux panneaux de forme pentagonale (45,46) en lesquels le panneau de forme hexagonale (42) est partagé, et un couvercle à Y (31) pour relier entre eux quatre trapèzes (44) d'un panneau de forme hexagonale (42) avec deux trapèzes (43) d'un panneau de forme pentagonale (41).

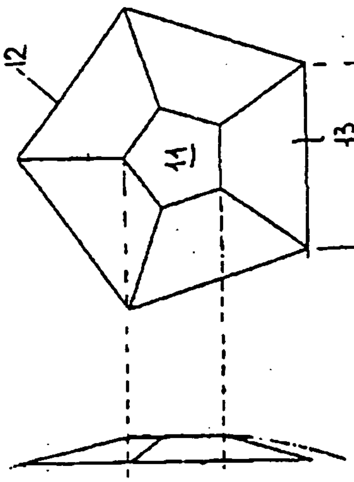


FIG.2

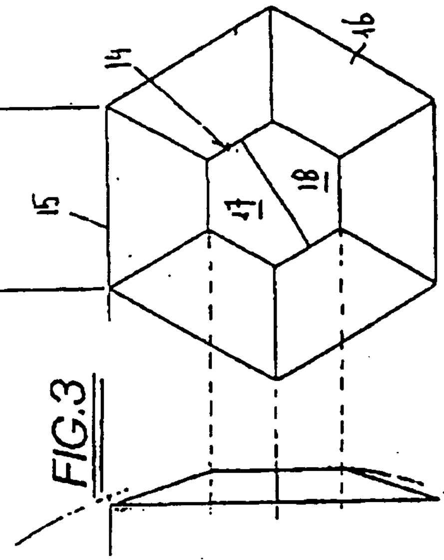


FIG.3

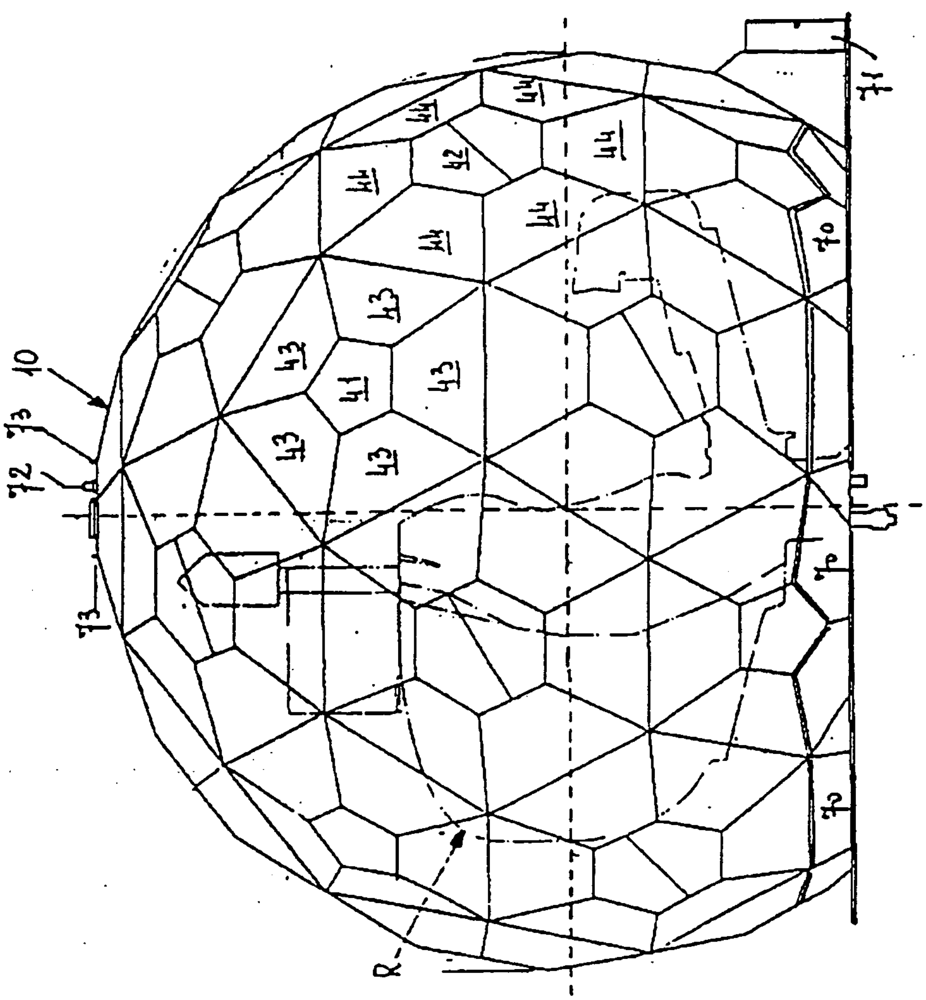
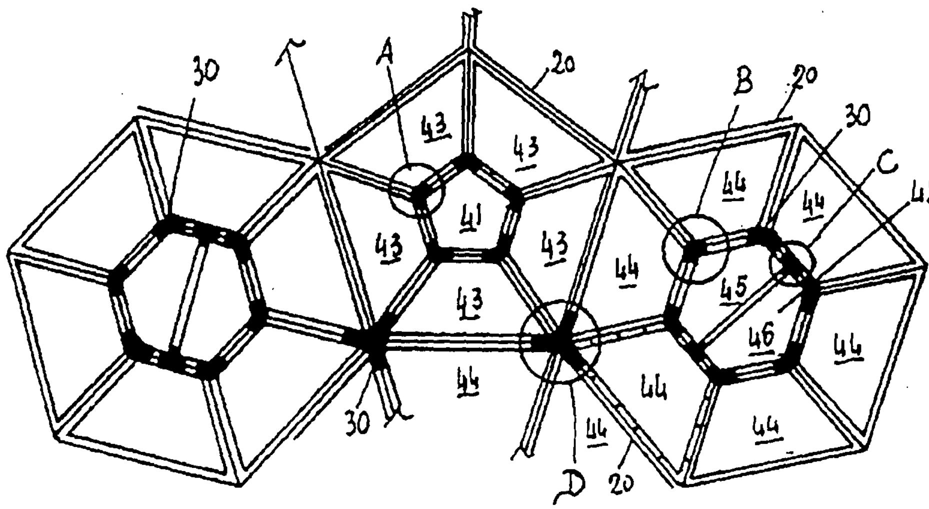
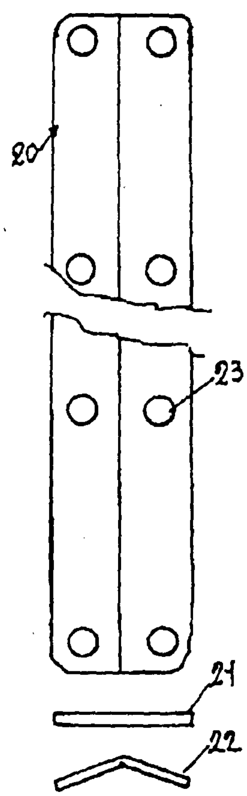


FIG.1

FIG.6





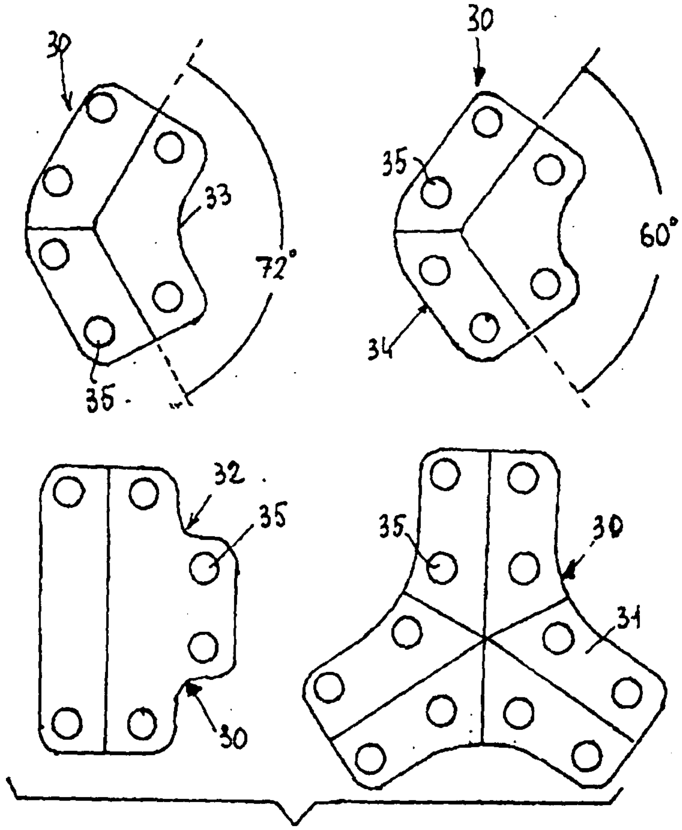


FIG.4

FIG.5

FIG.7

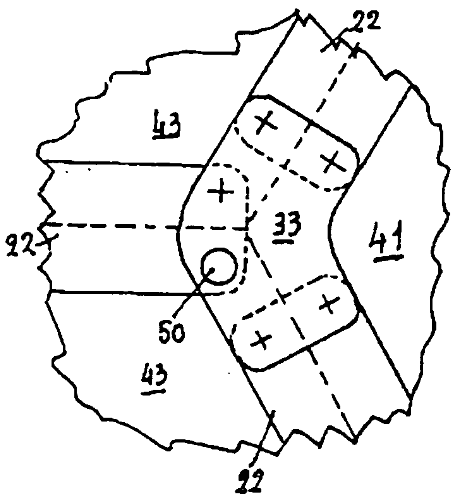


FIG.8

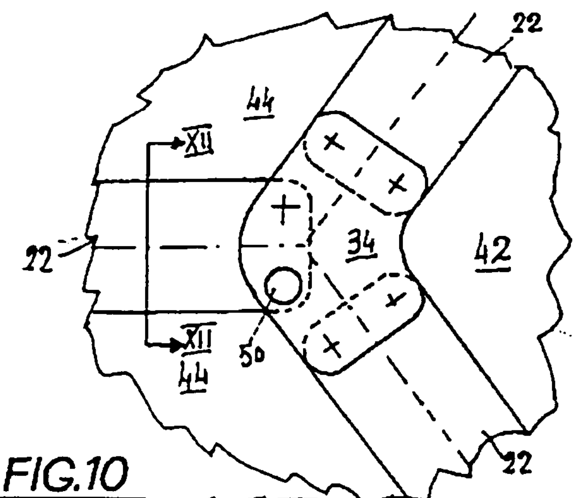


FIG.10

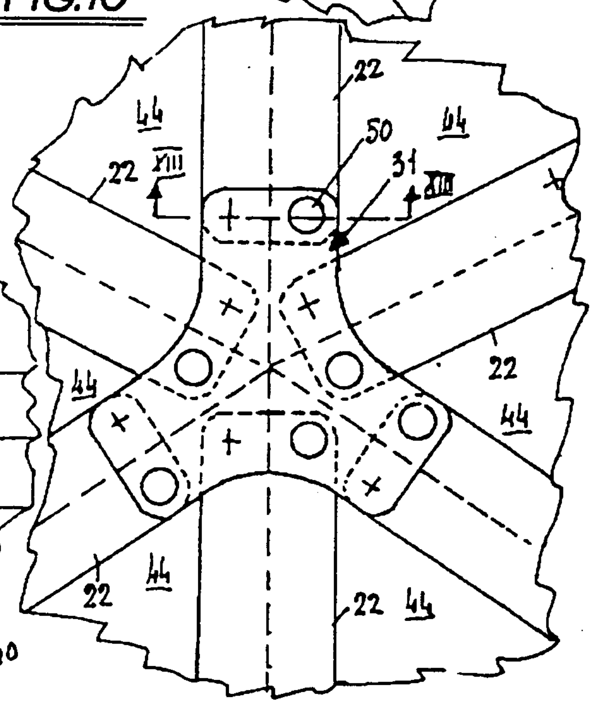
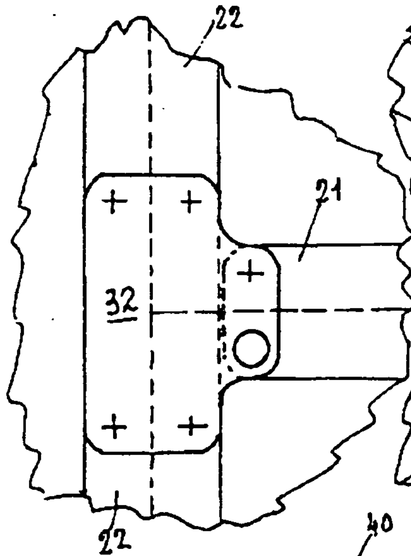


FIG.9



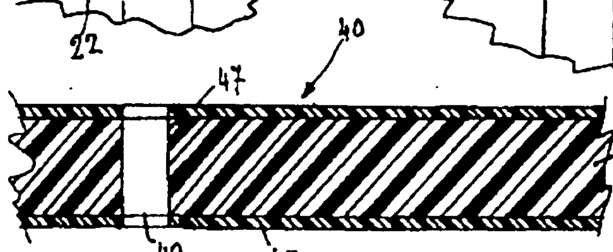


FIG.11

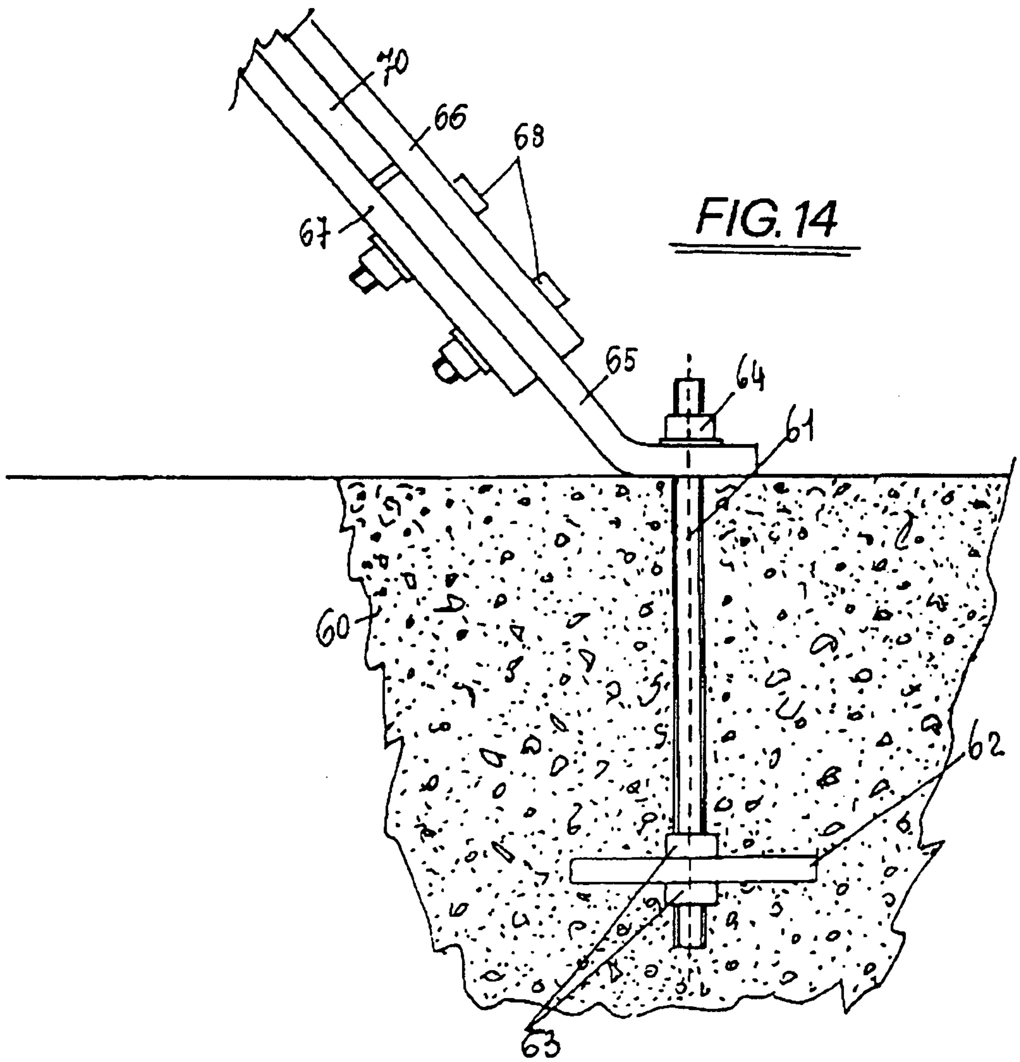


FIG. 14

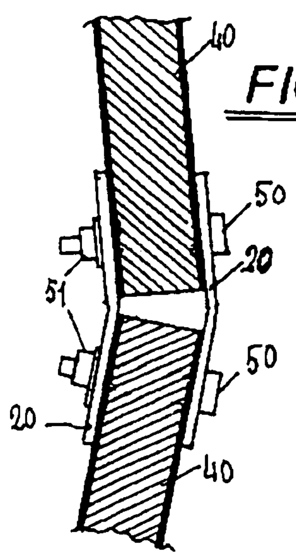


FIG. 12

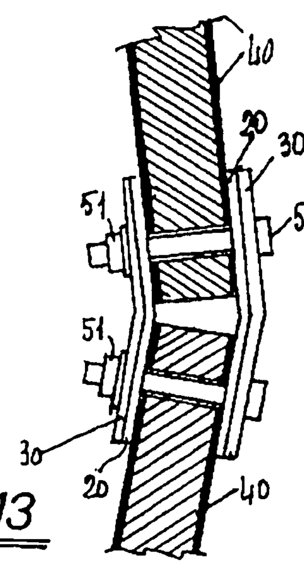


FIG. 13